OPERATING AND SERVICE MANUAL

biomation

MODEL K100-D GPIB

Preliminary Information Release

GOULD

Electronics & Electrical Products

MODEL K100-D GPIB

Preliminary Information Release

IMPORTANT NOTE

**THIS IS A PRELIMINARY MANUAL.
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This preliminary manual is supplied to permit earliest possible delivery of instruments. Additional and more complete information will be included in a subsequent final edition of this manual.

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Preliminary Information Release

K100-D
General Purpose Interface Bus
(IEEE Std. 488-1978)

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I. General Information

1.1 Cautionary Notice

This document contains preliminary information. Also, a prior knowledge of the normal (non-GPIB) use of the K100-D logic analyzer as contained in the K100-D Operation and Service Manual is assumed. You have been provided with this information so that you can gain a general familiarity with the operation of the K100-D GPIB interface. For elaboration on specific points, or questions regarding items not covered in the text, please consult the factory directly.

1.2 Interface Description

In general, the GPIB allows the user to operate the K100-D from the GPIB controller in a manner comparable to pressing keys when the K100-D is operated manually. Each key or switch on the front panel (except the AC power switch) can be logically "pressed" with the appropriate command. The only restriction is that there is no way to hold the key in a continuously "pressed" position (e.g., to cause a cursor to move continuously). Several "pseudo keys" have been added. These pseudo keys can be "pressed" by the appropriate command from the GPIB controller. They are included to allow more convenient remote control of the K100-D.

The GPIB also allows all information recorded by the K100-D to be transferred to the GPIB controller for further processing. If the controller is properly programmed, the K100-D can be used in an automated test system.

1.3 Specifications - Functional Capabilities

The K100-D GPIB option is an implementation of the IEEE STD 488-1978 published November 30, 1978 under the title "IEEE Standard Digital Interface for Programmable Instrumentation." Our implementation supports the following capabilities and electrical interface as defined by that standard.

SH1	-	Source Handshake, complete capability.
AH1	-	Acceptor Handshake, complete capability.
T5	-	Basic Talker, Serial Poll, Talk Only Mode, Unaddress if My Listen Address.
L3	-	Basic Listener, Listen Only Mode, Unaddress if My Talk Address.
SR1	-	Service Request, complete capability.
RL1	-	Remote/Local, complete capability (including Local Lockout).
PP0	-	Parallel Poll, no capability.
DC1	-	Device Clear, complete capability (including Selected Device Clear).
DT1	-	Device Trigger, complete capability.
C0	-	Controller, no capability.
E2	-	Three state drivers.

NOTE: As specified above, the K100-D supports the GPIB Device Trigger Interface Function. When the K100-D senses its listen address followed by a GET (Group Execute Trigger) command, the K100-D will provide a positive going TTL level pulse at the "GET" BNC connector on the back panel. The trailing edge of this pulse coincides with the DAV to DAV (i.e., low to high) transition during the handshake for the GET command. This pulse may be used as the K100-D operator wants. One possible use is as a K100-D trigger qualifier.

Data Transfer Rates

Mode	Response Time	Transmission Rate
Listen	500 us	2000 bytes/s
Talk	*	500 bytes/s

*Minimum response time for Talk mode is 4 to 11 ms, depending on which type of record is to be transferred. Actual response time may be many times greater depending on activity preceding Talk command.

Miscellaneous

Temperature. 0-50°C, operating range.

Warranty. All Gould/Biomation products are warranted against defects in materials and workmanship for one year from date of delivery.

Availability. The GPIB option can be purchased at the same time the initial order for the K100-D is placed. K100-Ds can also be retrofitted for this capability. Installation must be done at either the Biomation factory or an authorized international service center.

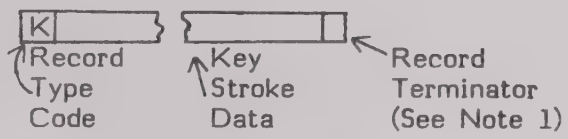
II. Record Formats

2.1 Information

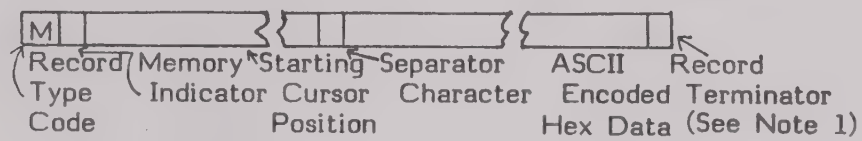
All information transferred between the K100-D and the controller is sent using just five different types of records. Each record has a specific format and purpose as discussed below. In addition, this section contains several helpful notes that make the operation and use of the interface easier to understand.

Record Type — Format

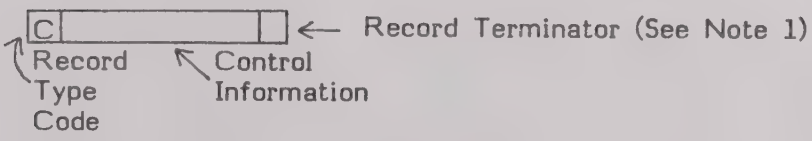
Keystroke "K"



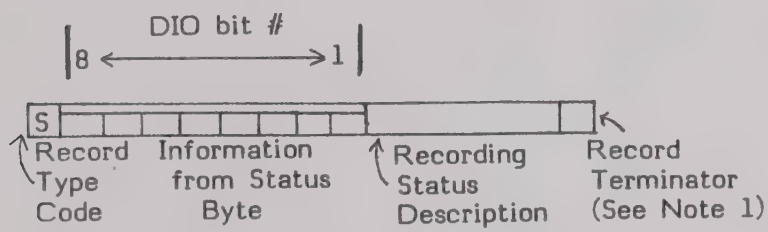
Memory "M"



Command "C"



Status "S"



Message "*"

Record types "*", "C", "K" and "M" may be sent to the K100-D when it is a listener. Record types "K", "M" and "S" may be sent by the K100-D when it is a talker.

NOTE: (1) The record terminator may be either a two ASCII character "Carriage Return (Hex 0D)," "Line Feed (Hex 0A)" combination or a single ASCII "Carriage Return." Either form will be accepted by the K100-D when it is a listener. The form used by the K100-D when it is a talker can be selected by the GPIB controller. See the explanation of the "CR" and "LF" commands under the description of record type "C" for more information.

(2) The K100-D always expects that a record sent to it will end with the terminator as described in Note 1. The record sent to the K100D may also be accompanied by a GPIB "END" message. The "END" message, if present, will be ignored. The GPIB controller can cause the K100D to assert the "END" message when the K100-D is a talker. See the explanation of the "END" and "UNE" commands under the description of record type "C" for more information.

2.2 Keystroke Records (Type "K")

Record Type Code must be an ASCII "K".

Key Stroke Data:

A variable number of ASCII key codes from the table are shown below. Blanks or commas may be inserted between key codes to improve human readability. If present, the blanks or commas are ignored by the K100-D.

The following ASCII key codes correspond to keys or switches on the K100-D.

ASCII Code	K100-D Key or Switch
0	0, 1 * time base, SAMPLE
1	1, 2 * time base, LATCH
2	2, 5 * time base, 0-7
3	3, msec, 8-F
4	4, 10 * time base, SPCL
5	5, 20 * time base, BIN
6	6, 50 * time base, OCTAL
7	7, usec, HEX
8	8, 100 * time base, TTL
9	9, 200 * time base, ECL
A	A, 500 * time base, VAR A
B	B, nsec, VAR B
C	C, INT, X1
D	D, EXT↓, X5
E	E, EXT↑, X10
F	F, X20
+	"1", INCR, +
-	"0", DECR, -
X	"X", SPACE, A=B
.	., FALSE, A≠B
G	ENABLE
H	TRIGGER
I	DELAY
J	THRESHOLD
K	CLOCK
L	INPUT
M	CLOCKS DELAY
N	EVENTS DELAY
P	FILTERED
Q	MANUAL TRIGGER
R	AUTO ENABLE
S	MANUAL ENABLE
T	AUTO ARM
U	

$U	AUTO MODE
$L	(LIMITS)
$S	STATUS
$D	DATA
$T	TIMING
$A	A (blue key)
$B	B (blue key)
$/	A/B
$=	A→B
$M	M→A
$?	SEARCH
$Q	SEQUENCE
$Y	SPECIFY
$*	CE
*	ENTER
#<	← CURSOR
#>	→ CURSOR
%<	← REFERENCE
%>	→REFERENCE

The following ASCII key codes correspond to K100-D functions which are available only through the GPIB.

ASCII Code	K100-D Function
&0	Enable False
&1	Enable True
&2	Trigger False
&3	Trigger True
&U	Manual Mode (opposite to AUTO MODE)
&-	Disarm (even if not Armed)
&A	W→A (transfer STATUS W parameters to STATUS A)
&B	W→B (transfer STATUS W parameters to STATUS B)
&?	Turn search on-even if already on (valid only in data mode)
&Z	Turn search off-even if already off (valid only in data mode)
&*	Erase display on CRT

2.3 Memory Modification Records (Type "M")

Record Type Code must be an ASCII "M".

Memory Indicator

A = Data to be placed in "A" memory.
B = Data to be placed in "B" memory.

Starting Cursor Position

16 channel mode of operation:

An ASCII decimal number from 0 through 1023 to show the first cursor position to be changed.

32 channel mode of operation:

An ASCII decimal number from 0 through 511 to show the first cursor position to be changed.

The starting cursor position numbers may be preceded by either leading zeros or blanks or a comma.

Separator character

A comma or a blank

ASCII encoded Hex Data

The data to be placed in memory.

16 channels-

Each set of 4 characters represents 1 cursor position. The 1st character of each set represents channels F-C. The 2nd character represents channels B-8. The 3rd character represents channels 7-4. The 4th character represents channels 3-0.

32 channels-

Each set of 8 characters represents 1 cursor position. The 1st character of each set represents "address" channels F-C. The 2nd character represents "address" channels B-8. The 3rd character represents "address" channels 7-4. The 4th character represents "address" channels 3-0. The 5th character represents "data" channels F-C. The 6th character represents "data" channels B-8. The 7th character represents "data" channels 7-4. The 8th character represents "data" channels 3-0.

The characters may be separated by blanks or commas.

NOTE: **The data in the "M" records is not affected by either sequence or polarity. That is, all channels are in the "M" record and the channels are always in the same order regardless of the current sequence setting on the K100-D. In addition, a "1" value for a particular channel always represents a high voltage level and a "0" always represents a low voltage level, regardless of the current channel polarity settings on the K100-D. A "1" for a particular channel in the "M" record will appear as a "0" in the Data Mode display on the K100-D, if the channel polarity is specified as "-".**

2.4 Command Records (Type "C")

Record Type Code must be an ASCII "C".

Control Information-

One of the ASCII codes described below.

Talk Record Terminator Commands

Code	Meaning
CR	Records generated by the K100-D when it is a talker will be terminated by an ASCII "Carriage Return". This command becomes effective with the next K100-D talk record.

Code	Meaning
LF	Records generated by the K100-D when it is a talker will be terminated by the two ASCII character combination of "Carriage Return", "Line Feed". This command becomes effective with the next K100-D talk record.

NOTE: Either of the above commands will override the power up default talk record terminator. The power up default talk record terminator is selectable by the Reset switch on the back of the K100-D (See Section VI).

GPIB "END" Message Control Commands

Code	Meaning
END	The final character of each K100-D talk record will be accompanied by an "END" message (i.e., the K100-D will assert the "EOI" line of the GPIB management bus). The final character will always be either an ASCII "Carriage Return" or an ASCII "Line Feed" depending on which form of the talk record terminator is currently in effect. This command becomes effective with the next K100-D talk record.
UNE	The final character of each K100-D talk record will not be accompanied by an "END" message. This command becomes effective with the next K100-D talk record.

NOTE: At power up the default is to have no "END" message.

Talk Record Type Control Commands

Code	Meaning
TA	The next 4 times the K100-D is addressed to talk, it will send the four "K" records which contain the Status "A" recording parameters.
TB	The next 4 times the K100-D is addressed to talk, it will send the four "K" records which contain the Status "B" recording parameters.
TW	The next 4 times the K100-D is addressed to talk, it will send the four "K" records which contain the Status "W" recording parameters.
TMA	The next time the K100-D is addressed to talk, it will send the first of one or more "M" records needed to transfer data from the "A" memory. The data will be transferred from and including the lower cursor position to and including the higher cursor position. Each "M" record except the last will contain the data for 16 cursor positions (16 channel) or 8 cursor positions (32 channel). The last "M" record may contain data for fewer cursor positions depending on the total number of cursor positions to be transferred. The K100-D must be addressed to talk once for each "M" record.

Talk Record Type Control Commands (Cont'd.)

Code	Meaning
TMB	Similar to "TMA" above except that the data transfer will be from "B" memory.
TDC	The next time the K100-D is addressed to talk, it will send one "K" record containing the settings for the Cursor and Reference in Data Mode.
TSB	The next time the K100-D is addressed to talk, it will send one "S" record containing information from the Status Byte and the recording status description from the lower left corner of the CRT. If no other Talk Record Type command is in effect, this command is assumed prior to each time the K100-D is addressed to talk.

2.5 Status Byte and Recording Status Record (Type "S")

Record Type Code will be an ASCII "S".

Information from Status Byte-

Eight bytes of information. Each byte corresponds to one bit from the Status Byte. The value of each byte will be either an ASCII "0" or an ASCII "1" depending on the value of the associated bit. The leftmost byte corresponds to DIO bit #8 of the Status Byte. The rightmost byte corresponds to DIO bit #1.

Recording Status Description-

The 3 ASCII character description of the current K100-D recording status. It will be identical to the description that appears in the lower left corner of the K100-D CRT.

2.6 Message Records (Type "*")

Record Type codes must be an ASCII "*".

Display Data-

The character string will be displayed on the K100-D CRT. The display will start in the upper left corner of the CRT. Each set of 52 characters will be used to build one row of display characters. Continuation from one row to the next is done automatically. The display data characters should be standard 7-bit ASCII characters from hex "20" (a space) to hex "5F" (an "_"). In addition, the following non-ASCII characters may be displayed:

Hex Value	Displayed Character
"6B"	u
"6C"	m
"6D"	n
"6E"	≠
"6F"	→
"70"	∓
"71"	∓
"72"	←

2.6 Message Records (Type *) (Cont'd.)

An ASCII Shift Out control character (hex "0E") will cause the characters following the SO character to be displayed in reverse video. An ASCII Shift In Control Character (hex "0F") will cause the characters following the SI character to be displayed in normal video. The display data in each separate "*" record is assumed to start with normal video characters unless the first display data character is a Shift Out. SO and SI characters are not displayed on the CRT and do not count toward the 52 characters in each row.

In Status mode, the amount of data to display must not exceed 20 rows. In Timing and Data modes the amount of data to display must not exceed 24 rows.

NOTE: **(1) The transfer of data over the GPIB can be faster than the K100-D's character display rate. It is the responsibility of the talker to allow sufficient delay between "*" records. If a second "*" record is sent too soon after the first, the data in the second "*" record will not be displayed and the K100-D will indicate an error condition. The error condition is indicated by a service request from the K100-D and by DIO bit #1 of the K100-D status byte being set to a 1.**

(2) The talker should be careful to insert only valid characters in the Display Data part of the record. An invalid character can cause erratic operation of the K100-D or can cause an ASCII "?" to appear in the display.

III. Status Byte Output

DIO Bit #	Decimal Value for a 1 bit	Meaning
8	---	Not used (Always 0)
7	64	GPIB RQS bit (See IEEE STD 488-1978)
6	32	0=16 channel; 1=32 channel
5	16	0=Power up OK; 1=Error in power up
4	8	0=No Recording in progress 1=Recording in progress
3	4	0="SEND" not pressed; 1="SEND"ppressed
2	2	0=Error light off; 1=Error light on
1	1	0=No GPIB record error; 1=GPIB record error

NOTE: **(1) A "1" bit in DIO3, DIO2 or DIO1 will be accompanied by a service request from the K100-D.**

(2) A Service Request from the K100-D will remain pending until the GPIB controller performs a serial poll or until the next time the K100-D sends an "S" record, whichever comes first. After completion of a serial poll or after the sending of an "S" record the Status Byte bits corresponding to DIO bit #s 1, 2, 3 and 7 are reset to 0.

(3) A "0" bit in DIO4 transmitted during an auto-comparison test signals the end of the test. The K100-D will revert to the RDY status and will not automatically re-arm. Therefore, this bit can be used as a flag signal to the controller that the desired trace has been recorded and stored in the K100-D.

IV. GPIB Information Line Display

In the Status Mode Display a GPIB information line is displayed whenever the GPIB is active. This line contains information to help the K100-D operator determine what is happening on the GPIB.

In Talk-Only mode the format of the line is:

GPIB**=TO

In Listen-Only mode the format of the line is:

GPIB**=LO

In the Talker/Listener mode the format of the line is:

GPIBaa=xx,yy,zz

where:

aa = two digit GPIB address of the K100-D.

	Mnemonic	Meaning	Corresponding States, IEEE Std 488-1978
xx =	TA	K100-D is addressed to be active talker or is active talker.	TADS or TACS or SPAS
	LA	K100-D is addressed to be active listener or is active listener.	LADS or LACS
	--	None of the above conditions is met.	TIDS and LIDS
yy =	LO	The K100-D can be controlled from the front panel. The GPIB controller has not issued a Local Lockout message.	LOCS
	RE	The K100-D cannot be controlled from the front panel unless the operator first presses the "LOCAL" key or unless the GPIB controller issues a GTL (Go to Local) message or sets the REN (Remote Enable) message false. The GPIB controller has not issued a Local Lockout message.	REMS *

IV. GPIB Information Line Display (Cont'd.)

Mnemonic	Meaning	Corresponding States, IEEE Std 488-1978
LW	The K100-D can be controlled from the front panel. The GPIB controller has issued a Local Lockout message.	LWLS
RW	The K100-D cannot be controlled from the front panel unless the GPIB controller issues a GTL (Go to Local) message or sets the REN (Remote Enable) message false. The GPIB controller has issued a Local Lockout message.	RWLS *

*The difference between REMS (Remote State) and RWLS (Remote With Lockout State) is that with REMS the operator may regain control by first pressing the "LOCAL" key. In RWLS pressing the "LOCAL" key will not have any effect. In RWLS only the GPIB controller can return control to the K100-D operator. Of course the operator can always regain control by turning the AC power off and then back on.

zz =	NP	The K100-D is not actively requesting service from the GPIB controller	NPRS or APRS
	SR	The K100-D is actively requesting service from the GPIB controller.	SRQS

V. Talk Only & Listen Only Modes

The K100-D supports the Talk Only and Listen Only modes of the GPIB. While there are probably many ways of using these modes, the two ways described below are likely to be the most common configurations.

A. One K100-D connected to a printer without a controller.

In this configuration the K100-D can dump status information and memory data to the printer. Since the K100-D encodes all its GPIB data bus messages in standard ASCII, these messages will print completely on almost any printer. The K100-D would be set to Talk Only while the printer would be in Listen Only.

V. Talk Only & Listen Only Modes (Cont'd.)

B. Two K100-Ds connected to each other without a controller.

In this configuration one K100-D can transfer all its status information and memory data to the second K100-D. The sending K100-D would be set to Talk-Only while the receiving K100-D would be set to Listen Only.

The information sent by the Talk-Only K100-D depends on the information being displayed on that machine's CRT. If the display is in Status Mode, then status information will be sent. The status information will be for A, B or W depending on whether A, B or W is being displayed. If the display is in Data or Timing Mode, then memory data will be sent. The memory information will be for A or B depending on whether A or B is being displayed. Only data between (and including) the cursors are sent. Cursor position information is also sent.

The sending of data is accomplished by pressing the "SEND" key. Each time this key is pressed, up to date information is transmitted by the Talk-Only machine. Approximately (14) fourteen seconds are required to send all 1024 memory positions to the listening machine. During this time the Talk-Only machine will show "BSY" in the recording status indicator. No special indication is given on the Listen-Only machine while data is being received. However, the display on the Listen-Only machine will be updated after all memory data is received.

VI. Address and Interface Mode Selection

The GPIB address of the K100-D and the interface mode (Talk/Listen, Talk Only, Listen Only) are determined by the positioning of dedicated switches. When the interface is installed as part of the original build order these switches are located on the back panel of the K100-D and are functionally marked as shown in Figure 5.1. Their current settings can be ascertained either by direct visual observation or by reading the GPIB Information Line Display as described in Section IV. The settings are read by the K100-D, however, only at the end of the Power-Up sequence. Any changes must either be made prior to turning on the instrument or by using the Reset switch.

The Reset switch causes the K100-D to begin the Power-Up sequence just as though the power had been completely shut off. Also, its position at the end of the Power-Up sequence is used to determine the End of Record terminator characters sent by the K100-D to the controller. This feature allows you to easily adapt your K100-D for use with a variety of controllers. For example, controllers made by Hewlett Packard and Systron Donner require both a carriage return (CR) and a line feed (LF) to properly terminate a record transfer while those made by Tektronix and Pet require a carriage return only. **Pushing down and releasing the Reset switch will cause the K100-D to reset, run through its Power Up sequence, read the new switch settings, and terminate all record transfers with both a carriage return and a line feed. Pushing the Reset switch down and then holding it up until the end of the Power Up sequence will cause the K100-D to terminate all record transfers with a carriage return only.** If access to the Reset switch or turning the power off is not convenient for your application you can also issue a direct command from the controller to the K100-D at any time specifying which terminator sequence the controller requires (see Section 2.4). The K100-D itself does not care and will respond properly to either sequence regardless of the controller's needs.

K100-Ds that have been retrofitted for GPIB operation have the same functional capabilities that have been described for units originally built with the interface. The switches, however, are located inside the instrument on the Threshold board rather than on the back panel. This board is the fifth board in from the right when viewing the instrument from the front. A single DIP switch mounted on the top of the board towards the back edge contains all of the necessary switches as described in Figure 5.2. Note that switch 8 provides the same record terminator selection as the external Reset switch that is used on instruments originally built with the interface. This switch does not, however, reset the K100-D since its internal location would make this particular feature virtually unusable and potentially hazardous to the operator. **If your K100-D has been retrofitted for the GPIB interface and you want to change the switch positions you must first disconnect the power to insure safe access, then carefully remove the top panel. When you have changed the switch positions to match your new requirements, simply replace the top panel and reconnect the power.** When the K100-D has finished the Power Up sequence it will read and incorporate the new switch settings in exactly the same manner as K100-Ds that were originally fitted with the interface.

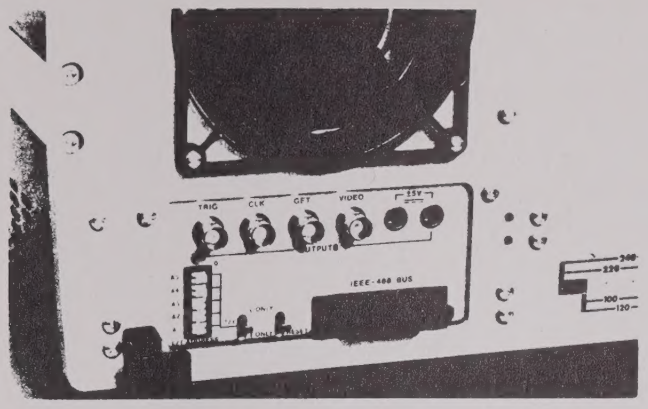
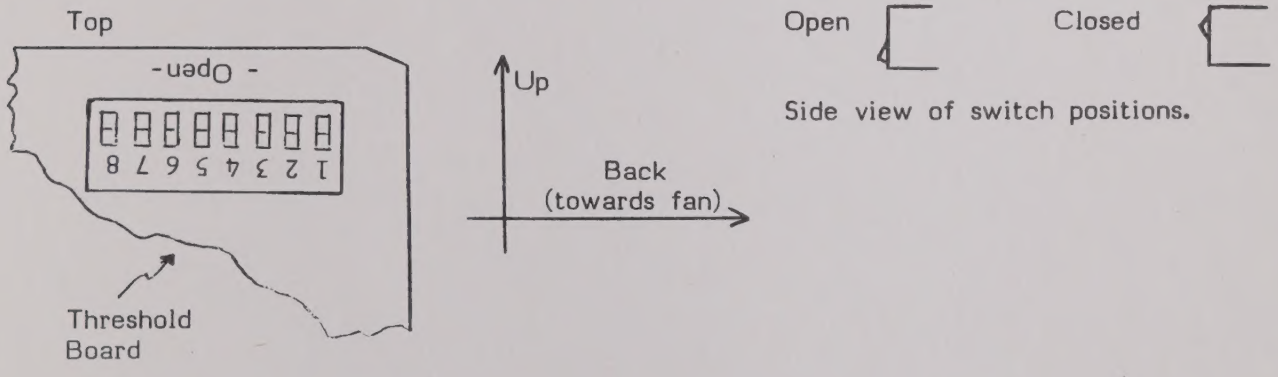


Figure 5.1. This photo shows the address and interface mode switches located on the lower left side of the K100-D back panel. Also shown are the GET output connector and the GPIB interface connector

Figure 5.2. K100-Ds retrofitted for GPIB have the switches located inside the unit instead of on the back panel. The functions and positions of these switches are as shown.



SWITCH FUNCTIONS

Switch #	Open	Closed	Switch #	Open	Closed
1	Add 1=1 (1)*	Add 1=0	5	Add 5=1 (16)	Add 5=0*
2	Add 2=1 (2)*	Add 2=0	6	Listen Only	*
3	Add 3=1 (4)*	Add 3=0	7	Talk Only	*
4	Add 4=1 (8)	Add 4=0 *	8	CR Only	CR+LF *

*Factory shipping positions

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